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ABSTRACT

This issue, number 30 in the series, is divided into the sections of: (1) Activities in Britain, (2) Overseas Activities, and (3) International Science and Mathematics Activities. Presented in a newsletter format, numerous topics of interest to secondary school science and mathematics educators pertaining to British education are included. The editorial presents an overview of the evolution of curriculum development, especially in science and mathematics, between the years 1966-1976. Activities in Britain discussed include the Resources for Learning Development Unit which started as a local follow-up activity at the conclusion of the Nuffield Foundation-sponsored Resources for Learning project in 1974. Overseas activities include bibliographic summaries of curriculum development projects in the Caribbean, Africa, and Europe. International activities described include material on the Commonwealth Association of Science and Mathematics Educators, symposia highlights, workshops, and international and regional conferences in science and mathematics. (EB)

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Science Education Newsletter

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SEN NO 30

CONTENTS

EDITORIAL

BIBLIOGRAPHIES FOR SCIENCE, MATHEMATICS AND TECHNICAL SUBJECTS AT PRIMARY AND SECONDARY LEVEL

ACTIVITIES IN BRITAIN

1. Resources for Learning Development Unit
2. Project Environment
3. Royal Society/Institute of Physics Committee on Physics Education
4. Educational Use of Living Organisms
5. University of Keele – MSc (Education) in Geological Education
6. Chemical Education – a part-time Diploma at Sheffield City Polytechnic
7. King's College, London – MEd course in Science Education
8. City of Birmingham Structured Mathematics Scheme
9. Statistical Education – a new Schools Council Project
10. Schools Mathematics Project
11. Continuing Mathematics Project
12. Computer Assisted Learning
13. PUBLICATIONS

OVERSEAS ACTIVITIES

14. Audio-visual material from Overseas Curriculum Development Projects
15. Caribbean
16. Africa
17. Europe

INTERNATIONAL ACTIVITIES

18. Commonwealth Association of Science and Mathematics Educators
19. Symposium: an Interdisciplinary Approach towards the Teaching of National Sciences at Secondary Level
20. Educational Technology in the Teaching of Chemistry
21. International Environmental Education Programme
22. Science Education and Nation Building – an International Workshop in Accra
23. ICMI – JSME Regional Conference, Tokyo
24. Third International Congress on Mathematical Education (ICME), Karlsruhe

EDITORIAL — Dennis Chisman, Head Science and Mathematics Education Unit, British Council, London

As the editor and compiler of the first issue of the Science Education Newsletter in **May 1966** it gives me very great pleasure to write a few paragraphs on the editorial page of this 10th Anniversary of the Newsletter, No 30.

I will not look back over these years with nostalgia but rather point out that we have in this decade experienced a fascinating evolution of curriculum development, especially in science and mathematics, and especially at the school level. Who could have foreseen in 1966 – when the Nuffield Projects in the separate sciences at 'O' level had just been published, when the Scottish separate sciences to 'O' grade were being introduced and when the school mathematics project (SMP) was being taught in an increasing number of schools in Britain – that there would be such a variety of curriculum projects to follow? These have been not only for secondary school students preparing for GCE 'O' level examinations, but for primary school pupils, for secondary pupils of lower academic ability, for students at the GCE Advanced level, even for university students. Who could have realised the innovations that were to follow in integrated or combined sciences, in primary mathematics or mathematics for the majority, and the major breakthrough in teacher education associated with the Science Teacher Education Project (STEP)? Most important of all, who could have anticipated the way in which countries all over the world, especially those in the developing world, would take up the challenge of curriculum development and introduce new schemes of work and new teaching approaches at all the various levels of the educational system?

In 1966 the British Council was trying to respond to the interest created by the original Nuffield and Scottish science and mathematics projects by providing sample materials, by assisting with short courses for teachers, by sponsoring visitors to Britain and by appointing a small number of Science Education Officers to work in the field, mainly in Africa. In those days the wishes of many countries coincided with the zeal of the Council's officers in believing that the Nuffield material and SMP could be adopted with only minor changes to an overseas environment and introduced to the educational systems of the countries concerned. After all, the corresponding projects from the USA, such as CHEM Study, which had appeared some 4 or 5 years earlier, were being introduced into many systems and translated into many languages without change. But, as in Britain, this was only a stage in the evolutionary process of curriculum development.

In Britain, curriculum development in science and mathematics has evolved from the major projects of national prestige to a much larger variety of smaller local projects, sponsored and coordinated in many cases by the Schools Council or its equivalent in Scotland, with greater emphasis on objectives and evaluation as well as with greater concern for the training of the teachers. The original Nuffield projects were essentially *ad hoc* curriculum development projects carried out in an almost amateurish way, though by experienced science teachers using their experience as the foundation of their work. This was fine. Now we combine classroom experience with research, and tradition with social relevance. Thus recent projects such as Science 5/13 incorporate objectives and evaluation into their structure and draw on the environment for their examples.

Likewise, in overseas countries many more curriculum development projects are truly indigenous, drawing on local experience, local environment, and often using locally produced apparatus and materials. Those concerned with curriculum development in such countries still of course look around – as true professionals should – to see what is going on elsewhere in the world, to study the recent literature and to examine sample materials. They still use expatriate advisers and perhaps more than ever they wish to see at firsthand what is happening in Britain and elsewhere. But having done all these things the trend now is to produce something that has its own national or regional flavour. Thus the Caribbean Mathematics Project, the Core Course Integrated Science of Sierra Leone and the Lesotho Integrated Science Project are examples of projects that are unique to those countries or regions. And there are many more which over the years have been described in the columns of SEN and have been summarised in the excellent Clearing House Report on Curriculum Developments in Science and Mathematics produced by the University of Maryland. (The 10th edition is now being compiled.)

This evolutionary trend in curriculum development, often associated quite deliberately with the establishment of Curriculum Development Centres or Science Teaching Centres, has been complemented to a greater or lesser extent by advisory help from Britain, from international agencies such as UNESCO/UNICEF and from many other countries. The small team of Council Science Education Officers in 1966 has now grown with the introduction of the Aid to Commonwealth Teaching of Science (ACTS) Scheme to around 30 specialists. There are also many other British advisers under various Technical Assistance Schemes involved in one way or another in curriculum development or teacher training.

The number of short visits by British science educators to countries overseas has also increased considerably in these last 10 years. Professional links have been established between groups working in Science Centres in Britain and many European countries as well as in the developing world. The number of visitors and Study Tours to Britain has increased also. Science and Mathematics Teachers Associations have developed in many countries and links between Associations have been forged in recent years particularly through the formation of the International Council of Associations for Science Education (ICASE) and the Commonwealth Association of Science and

Mathematics Educators (CASME). International Conferences have also helped to review trends in science and mathematics education and have been very useful not only for those who attended but also through the publications of their proceedings which are valuable resource materials for specialists working in these fields. Many more publications for science teachers and science educators have appeared, ranging from international newsletters on science education from a variety of sources to the excellent series New Trends in Science Teaching from UNESCO.

Indeed information is the main purpose of this Science Education Newsletter and it is to be hoped that its role in this direction will be ever more helpful. Nevertheless, it is still surprising to find that even those working in curriculum development in neighbouring regions or countries are often unaware of what is happening just nearby. So we have a long way to go before we can really feel even partially satisfied that we are doing all we can to share experiences.

What will the next 10 years have in store? Who can tell? Perhaps it will be more of the same mixture with a gradual alleviation, one hopes, of the problems that most countries face -- shortage of well-qualified and motivated teachers, large classes, inadequate facilities for teaching science, etc. But perhaps we shall see greater emphasis on new frontiers of curriculum reform such as rural/community development, or new approaches to the use of educational technology in teaching science in the formal as well as non-formal or out-of-school systems. (The use of balloon technology to transmit colour television to all schools in Korea as an integral part of new curricula may be a pointer in this direction, for instance.)

Whatever happens, however, I trust that those involved in these developments in the next decade, whether they be at the working level in the field, actually writing, developing and teaching new curricula or whether they be those involved in disseminating information and coordinating programmes and projects, will derive as much satisfaction and pleasure as those of us involved in the last decade have done. It is perhaps worth our while realising that those children who will be exposed to the efforts of curriculum developers in the next decade will be at the peak of their careers at the turn of this century and will be faced with the enormous problems, anticipated by sociologists, of a world population of more than 6000 million, of increasing poverty, and of precarious peace among nations.

The more that has been done, the more there remains to do. . . . . .

D G Chisman

BIBLIOGRAPHIES FOR SCIENCE, MATHEMATICS AND TECHNICAL SUBJECTS AT PRIMARY AND SECONDARY LEVEL

The previous series of SCIREFS is about to be replaced by a Book Supplement to Science Education Newsletter. The Book Supplement will consist of loose punched sheets and will also be available separately from your local British Council Office, or from London. It will be arranged in parts:

500 Science (general or integrated)

510 Mathematics

530 Physics

540 Chemistry

574 Biology (including Environmental Science)

600 Technical subjects

Each part will be printed on different coloured paper.

An indication will be given of the contents, the type of book and the age range for which it is intended. Teachers' books will be included.

The basic lists of books published before 1976 in Chemistry will be included in this issue and those for the other subject sections in SEN No 31. Beginning in January 1977 the Book Supplement will consist of updating sheets to add to the subject sections.

ACTIVITIES IN BRITAIN

1. RESOURCES FOR LEARNING DEVELOPMENT UNIT, Avon Education Authority

The Resources for Learning Development Unit of the Avon Education Authority is based in Bristol. It started as a local follow-up activity at the conclusion of the Nuffield Foundation-sponsored Resources for Learning Project in January 1974. It is supported jointly by the Avon Authority and the Department of Education and Science.

The Unit produces material in 5 subjects for use in the first 2 or 3 years of secondary education in local schools. Work in mathematics, English and social studies began in September 1974, and work in science and French was added from September 1975.

Material is produced by teams of practising classroom teachers, co-ordinated by an editor for each subject; the editor is a full-time member of the Development Unit. Teams for different subjects have developed rather different approaches and types of materials.

Mathematics:

The work in mathematics began with a questionnaire circulated to the heads of mathematics departments of all the Authority's secondary schools. This questionnaire sought information as to topics most widely taught in the first year. The most popular topics were chosen, and material on them developed. Altogether about 50 teachers have been involved in writing the mathematics material.

The material is produced at different difficulty levels, for the same topic. The teacher can choose the a appropriate approach for the individual children. Each approach, however, leads into a common set of work-sheets, thus helping the teacher to keep the class together as far as the coverage of topics is concerned.

A small team of teachers is responsible for writing the material on each topic, and these teams will continue into the second and third years' work on the same topics. Formative evaluation of the material is obtained by questionnaires to teachers using it. A teachers' handbook is also being produced; this will deal with the use of resource material, classroom organisation and so on.

Science:

The science project is producing a wide range of resource materials such as worksheets, games, film strips, booklets, which lend themselves to independent learning. They are suitable for first and second year secondary school children of a wide range of abilities.

14 topics have been chosen: Air, Looking for Patterns, The World Around Us, How Living Things Begin, Electricity, Water, Microbes, Estimating and Measuring, Insects, Forces and Movement, The Earth, Heating, Natural History, Basic Skills.

Each unit is suitable for use with any of the science courses used with this age range. It is not the aim of the project to produce its own course, but to allow teachers and pupils to use the packages on topics as required.

One or two local teachers are responsible for writing the material on each topic. The aim is to produce units quickly, with emphasis on modification in the light of trials, not perfection. After teachers involved in trials have had a chance to evaluate this resource – based independent learning method, the project will make recommendations about suitable classroom organization.

Further information may be obtained from: Resources for Learning Development Unit, Redcross Street, Bristol, BS2 OBA.

2. PROJECT ENVIRONMENT (SEN 18.23 and 25.15)

Previous issues of SEN outlined the establishment of this project, whose aim was to explore aspects of environmental education throughout the school years from the age of 8; materials and approaches were to be developed to help teachers to encourage in children an enlightened interest in the environment and its management.

The initial period, up to the end of 1970, was spent in forming a picture of the current state of affairs upon which to base action, and in making wide contacts. The team talked to teachers and headteachers, saw their work, and met Local Education Authority administrators, advisers, research and curriculum development officers. In addition, contact was made with a wide range of organizations concerned with town and country planning, forestry, conservation and other environmental matters. Many aspects of environmental education needing urgent attention were identified. In assessing what appeared to be the priorities, the project team decided to concentrate on the following areas:

1. To help schools to play their part in making pupils aware of mankind's dependance on his natural environment and the dangers which threaten it. In so doing the project set out to introduce into the

curriculum material which pupils would consider relevant to contemporary life and which was also educationally valid. This was based upon a series of environmental topics of direct importance to every individual and sought to develop understanding, and personal commitment towards a sensible relationship to their environment, in older pupils in the sixth form and early leavers' groups.

2. The educational use of the school estate as an outdoor resource area for all parts of the curriculum.

3. The development of an approach to ecology through the study of the ecological principles involved in the management of living things in farm, garden and forest. This guidance is particularly needed by the many rural studies teachers who accept the need for a more scientific and environmentally oriented approach to their subject, and for closer connections with other curriculum areas, but who as yet see no clear role for themselves.

4. Involving schools in practical projects in association with planning departments and public debate on planning matters.

5. The development with schools in the middle years of new and more educationally viable ways of using the nature trail concept in several areas of the curriculum.

In view o the far-reaching implications of education for the environment throughout the curriculum and the local nature of pupils' needs and learning resources, it was not appropriate to develop prescribed courses and put them on trial. Instead the team set out to find materials which teachers in many areas of the curriculum could adapt to their own requirements. In doing this, the team received the enthusiastic support of teachers in a policy of joint development of materials in the schools. They suggested ideas and stimulated activities so that the materials were evolved *with* teachers rather than being prescribed.

The following materials have been published by Longmans, Pinnacles, Harlow, Essex:—

Education for the Environment £1.25
The project handbook, describing the aims and approach and discussing general views about education for the environment.

Learning from Trails £1.90
A guide for teachers in junior and middle schools.

The School Outdoor Resource Area
A handbook of suggestions for setting up, maintaining and using a variety of facilities provided by school grounds, on both favoured and less favoured sites.

Ethics and Environment £2.50
A teacher's handbook, covering such topics as population, food, land use and planning, resource use and recycling water, men and other creatures, pollution, environmental quality, and man in nature.

The final volume will be published shortly:

Production Ecology:
A book for teachers and sixth form pupils, providing an approach to ecology through the managed systems of farm, garden and planted forest.

3. ROYAL SOCIETY/INSTITUTE OF PHYSICS COMMITTEE ON PHYSICS EDUCATION

The variety of A level Physics syllabuses followed in British schools prompted the Joint Committee to set up a working party to look into differences between them, and the resulting differences in background knowledge of first-year Physics undergraduates. In other words, what topics is it fair to assume will be familiar to all students? The working party examined not only content of the syllabuses themselves but also their treatment of different topics and the examination papers which are based on them. One difficulty in compiling a survey of common topics is that in practice, there are at least three versions of a syllabus: the official printed list of topics, the teacher's interpretation of it, and the topics actually learned by a given student. Information on the latter is unfortunately not available, of course.

The resulting report of the working party "Entry to Physics Courses at the Tertiary Level" provides a very useful comparative survey of British A level Physics syllabuses and examinations.

Copies of the booklet are available from:

The Education Officer
Institute of Physics
47 Belgrave Square
London SW1X 8QX

The price is 25p per copy (including postage) in the UK. Overseas readers may obtain the booklet free of charge.

4. EDUCATIONAL USE OF LIVING ORGANISMS (SEN 15.5, 17.4, 25.6)

The following materials produced by this Schools Council project have been published by English Universities Press, St Paul's House, 8/12 Warwick Lane, London EC4P 4AH:–

The Educational Use of Living Organisms: a Source Book edited by P J Kelly and J D Wray.
This includes information on individual organisms suitable for use in schools, including biological information, source of supply, maintenance and use; information on the particular use of suitable organisms and outlines of appropriate techniques. There are also sections on medical and legal aspects of the use of living organisms, supply and conservation, and appropriate equipment and apparatus.

Booklet for Teachers

Animal Accommodation for Schools by J D Wray and J F Gaitens	£0.60
Small Mammals by J D Wray and J F Gaitens	£0.75

The following are in preparation:–
Organisms for Genetics by L C Comber
Micro-organisms by P J Fry
Plants by C D Bingham
Organisms in Habitats by P J Kelly and J D Wray

Slide Sets and Wall Charts relating to Small Mammals
These wall-charts on sexing and handling are available: Rat and Mouse; Hamster and Guinea-Pig; Rabbit and Gerbil (all price £4).
Slides will also be produced to complement the booklet on "Small Mammals".

In addition to the materials listed above, EUP have published:–

Recommended Practice for Schools Relating to the Use of Living Organisms and Material of Living Origin.
This is a code of practice on dissection and experimentation in schools.

5. UNIVERSITY OF KEELE – MSc (Education) in Geological Education

The one year full-time course leading to the MSc (Education) at the University of Keele (SEN 22 and 26) has been extended to include Geological Education.

The MSc course at Keeble provides an opportunity for curriculum studies and research training in Mathematics Education and Science Education as well as specialist studies in Biology, Chemistry, Geology, Mathematics. Physics and Physical Science.

Opportunities also exist for research studies in Mathematics Education or Science Education leading to the MA or PhD by thesis on the basis of either part-time or full-time study.

Further particulars from The Registrar, University of Keele, Keele Staffordshire ST5 5BG.

6. CHEMICAL EDUCATION – part-time Diploma, Sheffield City Polytechnic

A new CNAA Postgraduate Diploma course in Chemical Education is due to start at Sheffield City Polytechnic in September 1976. The course has been developed by a joint planning committee drawn from the former Sheffield Polytechnic and City College of Education (which, together with Totley-Thornbridge College of Education, merged to form the new Sheffield City Polytechnic on 1 April). The planning committee recognised that the science curriculum development projects of recent years, together with the increased availability of learning/teaching aids, school re-organisation, syllabus revision and the like, have had a profound effect on the teaching of chemistry and on the professional duties of chemistry teachers. The course seeks to meet the severe demands which such changes have collectively brought on the chemistry teacher, and was devised using the findings of a questionnaire completed by chemistry school-teachers in South Yorkshire and North Derbyshire.

The areas of study are chemistry, chemical curricula, chemical education and educational studies; project work is carried out for one-third of the course time. Considerable flexibility has been provided to enable students to select their own routes through the programme, in order to cater for their particular backgrounds and teaching situations. The range of entry qualifications is wide, but at least three years' teaching experience is normally required.

Attendance is for six hours per week (Tuesday afternoon and evening) over two academic years, although more flexible arrangements will obtain for the project work which occupies the last two terms.

Further information is obtainable from Dr M Goldstein, Head of Department of Chemistry, Sheffield City Polytechnic, Pond Street, Sheffield S1 1WB.

7. KINGS COLLEGE, UNIVERSITY OF LONDON – M Ed Course in Science Education

This course, intended primarily for teachers of science in schools and colleges, is concerned with current developments in science education. It comprises co-ordinated studies in education and either chemistry or physics, under the joint supervision of the Faculty of Education and the relevant department of the Faculty of Natural Science. It extends over one calendar year of full-time study.

The course allows for a broad review of either chemistry or physics, related to the needs of individual students and concerned with current trends, and the special study of one topic. It is intended that this special study be related to themes featured in contemporary aspects of science education, and lead to the development of a research project. The education component of the course will include, in addition to a direct study of problems of science education, relevant background studies of a philosophical, psychological and sociological nature.

Entry Qualifications

1. A first degree in science at honours standard of a British university (or equivalent qualification) involving a substantial content of either chemistry of physics; and

2. A postgraduate certificate in education or equivalent, or a three year period of teaching; and

3. A relevant advanced diploma in education. Candidates who do not possess an appropriate advanced diploma in education will be required to sit a qualifying examination beforehand or supply essays or other materials as specified by the college.

Further information and application forms are available from the Registrar, Kings College, Strand, London WC2R 2LS.

8. THE CITY OF BIRMINGHAM STRUCTURED MATHEMATICS SCHEME

In the summer of 1970 the City of Birmingham, faced with a long-term shortage of specialist mathematics teachers in its schools, set up working parties of City teachers with the following aims:–

1. To provide support for non-specialist teachers who were having to teach mathematics, possibly without any guidance from mathematics specialists.

2. To develop this support in such a way that in the longer term it could be used to provide an improvement in mathematical education within the City.

In many cases those teaching mathematics had no mathematical training and often very little experience of teaching the subject. In consequence the support material had to be simply structured, and had to progress in easy stages for the benefit of both teachers and children in non-selective schools. The pupils' material was to be planned so that a minimum of teacher preparation would be needed.

In the academic year '71–'72 a syllabus for the first years' work of a general secondary course was drawn up by a working party of teachers, and a series of packages dealing with the individual mathematical topics in this syllabus is being produced. Some typical package titles are "Simple Graphs", "Introduction to Sets" and "Capacity". So far some forty different titles have been produced, covering the first two years' work in a secondary school; a few titles deal with third year topics.

A package consists of a box containing enough work for thirty children for ten to fifteen lessons. A teacher's handbook is included with every package and contains all the work material for the children with answers, notes for the teacher on how to use the material, a list of apparatus needed and a suggested breakdown of the topic into lesson units. A list of simple learning objectives is given in the handbook together with pre-tests and post-tests so that some indication of the child's achievement of these objectives may be obtained.

The work materials for the pupils are mostly worksheets and/or programmed texts written by volunteer teachers and edited by the full time staff, with some commercial material. Practical activities are included in an increasing number of packages; enrichment materials give teachers the option of synchronising the start of each new phase, or of allowing the children to proceed at different speeds. Teachers may use the materials in any way they choose.

At any one time the Scheme sends its packages free of charge to between twenty five and fifty schools.

The Scheme has developed in the following ways:–

1. The material consists very largely of written work so that there are problems in reading for some children; two teachers were appointed in September 74 to modify the materials and prepare audio-visual aids for this group of children.

2. The more general use of illustrations, tape material, overhead projector transparencies, slides and film strips is being developed.

3. Work is being produced for fourth and fifth year children not following a specialist mathematics course. The first set of packages are being written under the general title of "Money Management"; those so far in use are "Earnings", "The Motor Car", "Insurance" and "Setting up a home".

4. In-service courses are held for teachers.

5. The need for group and individual work in mixed ability classes is leading some specialist teachers of mathematics to look to the Scheme for support and for ready made materials, including worksheets, which they can use or adapt rather than face the daunting task of preparing them from scratch.

To assist in evaluation each package has always contained a teacher's comment sheet; using these, pre- and post-tests and a variety of other techniques the effectiveness of several packages has now been tested and some have been rewritten in the light of the results. In May, 1975 the Schools Council appointed an evaluator to assess the Scheme in particular with respect to its first intention of helping the non-specialist teach mathematics.

Further information may be obtained from:

The Director
Structured Mathematics Centre
Reaside School
Rea Street South
Birmingham
B5 6LB

9. STATISTICAL EDUCATION – A NEW PROJECT

A project on statistical education (POSE) at school level has been set up by the Schools Council and the first Newsletter (Winter 1975/76) has been issued. The project has been funded for a period of three years from September 1975 and will investigate statistical education in the age range 11–16. The Director is Peter Holmes, the Deputy Director is Neil Rubra and the Project Officer is Ramesh Kapadia. Full details of the terms of reference are given in the Newsletter. Enquiries should be sent to the project offices at the Department of Probability and Statistics, The University, Sheffield, S10 2TN.

10. THE SCHOOLS MATHEMATICS PROJECT (SEN 18.18, 23.13, 27.13)

The SMP was established in 1961 to reform secondary school mathematics in Britain by producing new syllabuses, examinations and textbooks. Now, in 1976, more than half the secondary schools in England and Wales are using the SMP materials with their pupils, in-service courses are held in all parts of the country each year and SMP has been adapted or translated for use throughout the world.

The SMP is an independent educational trust and its work is accomplished by about 150 teachers who help write the materials. The administration and responsibility for co-ordinating the project has been in the hands of its founder and Director, Dr Bryan Thwaites, Principal of Westfield College, London. Although he will continue as Chairman of the Trustees, Dr Thwaites has now retired from the Directorship and, to mark the occasion, the Cambridge University Press held an exhibition at their London headquarters in January. It illustrated 14 years of development and pointed the way ahead with slides, OHP material and an audio visual tape to show the full range and scope of what is undoubtedly the most widely implemented curriculum development project on any subject in Britain.

The SMP is increasing its scope and responsibility with plans well in hand for new resources for children from 7 to 19 years old. The continuing work will be managed by the new Executive Director, John Hersee. Research Director Alan Rogerson and Project Assistant Sylvia Jennings. Mr Hersee is also Chairman of the Teaching Committee of the Mathematical Association, and was until recently Head of the Mathematics Department at Clifton College. Cambridge University Press, whose association with the SMP dates from the beginning, will continue to act as publishers of the material.

11. CONTINUING MATHEMATICS PROJECT (see SEN 20.14 and 24.7)

The project was set up in 1971 to continue the mathematical education of students in sixth forms and colleges who are not specializing in mathematics; to meet their needs, materials for independent learning have been developed, so that constant recourse to a specialist teacher of mathematics is not necessary.

The materials are intended for sixth-form students taking subjects such as economics, geography and biology. They will also be relevant to sixth form arts students, students at colleges and departments of education, colleges of further education, polytechnics and universities.

The material is structured in units, each unit taking an average student from two to three hours to work through. The units will be self-instructional and suitable for use by individuals or small groups. Some units (Category 1) will cover basic O-level topics which are necessary to support more advanced work. Units in Category 2 will provide introductions to a variety of mathematical topics and will illustrate ways of expressing problems in mathematical form. Units which are sequential and dependent upon one another to form a course fall into Category 3. Under these headings trial materials have been prepared as follows:

Category 1 (single, independent revision units): Positive and Negative Numbers; $y = mx + c$; Inequalities; Working with Ratios; Transformation of Formulae; Trigonometry of the Right-Angle Triangle; Trigonometry of the General Triangle; An Introduction to Sets; ${}_nC_r$ – Calculation and Use; Indices and Standard Form; Computation with Logarithms; Theory of Logarithms; Using Logarithms to Determine Relationships.

Category 2 (introductory units): Flowcharts and Algorithms; Critical Path Analysis; Further Critical Path Analysis; Systems; Information and Coding I; Linear Programming; Mathematics of Finance I.

Category 3 (short courses of work): Information and Coding – 4 units; Elementary Calculus – 5 units; Growth in Biological Populations – 1 unit; Descriptive Statistics – 3 units; Elementary Probability – 3 units; Hypothesis Testing – non-parametric methods – 3 units; The Binominal and Normal Distributions – 6 units; The chi-square test; Correlation.

Although a substantial part of the project's output is in programmed text form, a variety of teaching media and modes is employed. Audio-visual forms will be used where they have advantages in teaching effectively and can sustain motivation.

The following procedure is adopted in the production of each unit:

(i) **Outline**: once the need for a unit is ascertained, an author writes an outline.

(ii) **Moderate**: the outline is discussed by the project team and moderators.

(iii) **Develop**: the author develops Teacher's notes, a summary of the unit and student's "feedback" sheets.

(iv) **Moderate**: discussion and revision of unit.

(v) **Test**: developmental testing by team members with small groups of students.

(vi) **Moderate**: from students' responses, much revision is often seen to be necessary.

(vii) **Test**: field testing, in schools where staff members act as tutors.

Further revision will take place before final publication.

The testing of materials in trial schools provides not only information for the modification of units, but also insight into students' attitudes to mathematics in general and the units in particular; it also gives the chance to examine the problems and experiences of using self-instructional materials. The project, due to close in 1976, has been granted a two-year extension with funds from the Schools Council and the Council for Educational Technology, in order that a programme of dissemination may be carried out. A newsletter, "Continuing Mathematics Project News", is available free on request from the Project, Mantell Building, University of Sussex, Falmer, Brighton BN1 9RF, Sussex.

12. COMPUTER ASSISTED LEARNING

We much regret the existence of some errors in our report on the National Development Programme in Computer Assisted Learning (SEN 29.15).

The third paragraph should have read as follows:–

"The University projects include a number in the field of science, such as the **Computers in the Undergraduate Science Curriculum** (CUSC) project at University of London, Chelsea College and the University of Surrey in **physics**, and **biology** as well as chemistry, and another project in chemistry (CALCHEM) coordinated by Dr Peter Ayscough of the University of **Leeds** involving 9 universities and polytechnics in the tutorial and **problem-solving** use of the computer in chemistry (not just physical chemistry).

The CUSC project is based on the simulation approach (ie models for problem-solving). There is one computer managed project developed at the school level in **biology**."

13. PUBLICATIONS

13.1 **Using Science Apparatus: A Guide for Teachers**

This is a UNICEF publication prepared as a guide to the use of science teaching apparatus, particularly that supplied under the UNICEF Aid Scheme to various parts of the world. The book is an illustrated description of the use and maintenance of the majority of items in the primary and secondary science sections of the UNICEF Guide List known as the Eve List. It is intended principally for teachers at the upper primary and lower secondary levels, but it will also be of use to teachers at higher levels who wish to use apparatus which they have not previously handled. The book contains more than 200 pages and is divided into sections dealing with various aspects of science teaching across the whole range of biology, chemistry, physics and general science. It is well illustrated with photographs. The text and photography are by Keith Warren, a British consultant to UNICEF.

The book is available from UNICEF offices, from UNESCO or from suppliers of UN publications. The headquarters of UNICEF is United Nations, New York 10017, USA.

13.2 **Interdisciplinary Science Review,** published quarterly by Heyden & Son Ltd

This new journal is the first devoted to critical interdisciplinary reviews of the pure and applied, the social and economic sciences. The thinking behind its introduction is that much of the most interesting current research in the sciences arises when specialists of different disciplines work together.

Interdisciplinary Science Reviews (ISR) will publish the following:

Reviews of the border areas between two or more natural sciences

Articles on the effects of science and technology on society

Contributions which further the cultural and intellectual links scientists are forging with the arts and humanities.

The first issue contains the following articles:–

Promises and Problems of Science: Some Economic and Ethical Aspects	Dr H Guyford Sterer
The Contribution of Science to the Economy: A United Kingdom Point of View	Sir Alan Cottrell
The Game of Evolution	Prof Manfred Eigen Dr Ruthild Winkler
The Aesthetics of Engineering	Sir Misha Black
The OKLO Nuclear Reactors – 1800 Million Years Ago	Roger Naudet
Activity, Exploration, Curiosity and Fear: An Ethological Study	Prof Anthony Barnett Dr P E Cowan
Phytochemistry: The World of a Chemist Among Plants	Dr Leslie Fowden
Bio-Technology: The Industrial Production of Natural Substances	Dr Paul Prave Dr D A Sukatch Dr U Faust

ISR will be published quarterly. The 1976 subscription (4 copies) is £17.00 in UK and Eire, and £22.00 ($44.00) overseas, postage included. The journal is obtainable from:

Heyden & Son Limited
Spectrum House
Alderton Crescent
London
NW4 3XX

13.3 **Combined Science: Books 1 & 2 and Teachers Guide 1 & 2** – by Green, Petford, Short & Walker. Published by John Murray. £6.40 total price.

These books are intended for the first two years of a secondary school integrated science course. The authors are practising school teachers who took part in the Nuffield Combined Science trials. The books are well

illustrated with clear colour diagrams and some photographs. Each of the four volumes has an index. The general appearance, typography, layout and paper of the books is attractive. Book 1 is made up of ten chapters, the titles being: Our World; Wonderful Worms; Making Things Pure; Sweet and Sour; Measuring Things; Volume and Density; Heating Things; What is Air; Water; Reproduction and Growth. Book 2 is made up of twelve chapters whose titles are: Forces; Supporting Forces; Movement in Animals and Plants; Energy; Electricity; Moving Matter; Heat Travel; Pressures of the Earth; Soil; Micro-Organisms; Flowers, Fruits and Seeds; Insects.

The teachers guide gives answers to questions posed in the pupils books and lists of materials and apparatus required for the experiments.

The only obvious criticism is one which would apply to almost all school science texts produced in the last few years, and it is this: when the Nuffield O-level materials were produced the new ideas were startling and most of the experiments, demonstrations, suggested visual aids etc were really original, but ever since then there seems to have been little new thinking, and such things as circuit boards and syringes are becoming boring. Of course the ideas are still new to the pupils but it would be nice to review some books which really did present post-Nuffield innovations. Integrated science where the chemistry, physics and biology are really intertwined and enmeshed would be welcome, rather than the situation in the books under review where each chapter can clearly be assigned to its particular discipline.

The language of the books is simple and although they are intended for the United Kingdom situation they could be used overseas better than many of their rivals.

13.4 **Progress in Chemical Education**

The proceedings of a symposium of this title held at Sheffield Polytechnic, in association with the North East Region of the Chemical Society Education Division have been published (1975). The papers and abstracts mainly discuss aspects of innovation and research in chemical education at tertiary and school level.

The contents include:

CURRICULUM STUDIES

1 A Chemistry Component of a Humanities Degree
B S Furniss, J Mendham and J R Parsonage,
Thames Polytechnic

2 A New Tertiary Chemistry Course – Consideration of Technological, Economic and Environmental Constraints
J McIntyre and D J M Rowe
University of York

3 A Modular Individualised Learning Approach to Sixth-Form Scientific Studies – A Possible Pattern for the Future
R C Bailey, W W S Gill and W J Wilbourn
Gateway School, Leicester

TEACHING-LEARNING TECHNIQUES

4 The Identification and Attempted Remediation of Student Deficiencies in the Early Weeks of Undergraduate Chemistry Practical Work
L Davies
University of Salford

5 The Role of Simulation Techniques in the Teaching Laboratory
A F Johnson
University of Bradford

6 The Interactive Use of a Computer Terminal in a Chemistry Laboratory
D M Ames, D A Leathard and G H W Milburn
Sheffield Polytechnic

7 Computer Assisted Learning With a Mini-Computer
Robert Pritchard and Peter Groves
University of Aston

8 The Feedback Lecture – Use of Coloured Cubes
R B Moyes
University of Hull

9 Games for Learning Spectral Interpretation
D F G Pusey
Polytechnic of the South Bank, London

10 A Personalised System of Instruction in Physical Chemistry
M H Freemantle and T C Blackler
Polytechnic of the South Bank, London

11 A Programmed Course on Molecular Symmetry and Group Theory
Alan Vincent
Kingston Polytechnic

12 Student Attitudes to Videotape Recordings
K Norton and D M Servant
Wolverhampton Polytechnic

13 Progress in Project Work
D R Browning
Bristol Polytechnic

ASSESSMENT

14 An Analysis of Student Performance in the 1973 Nuffield Physical Science Examination
J R L Swain
Wilson's School, Wallington

15 The Use of Weighted or Unweighted Aptitudes in the Assessment of Science Laboratory Technicians
A Crowder and M J Frazer
University of East Anglia

16 A Pilot Study in the Quantitative Assessment of Industrial Training
B G Hutley and J B Turner
Sheffield Polytechnic

17 A Case Study of the Effect of Linear Standardization of Examination Marks on Final Degree Classifications in Applied Chemistry

E Leblond, R J D Rutherford and D S Trickey
Sheffield Polytechnic

ABSTRACTS ON VARIOUS TOPICS

Copies are available £2.00 post free or £2.40 post free if resident outside UK or Eire from Dr S Trickey, Editor, Sheffield City Polytechnic, Sheffield S1 1WB. Please send a cheque made out to Sheffield Polytechnic with your order.

13.5 **Teaching and Learning in Chemistry (see SEN 27.18.6)**

Copies are still available of the second printing revised edition (1973) of the proceedings of a symposium held at Sheffield Polytechnic in association with the Chemical Society Education Division.

Copies £0.50 post free or £0.90 post free outside UK and Eire are available from Dr S Trickey (Editor), Sheffield Polytechnic, Sheffield S1 1WB.

13.6 **Chemistry Cassettes.** Edited by P Groves. Published by Educational Techniques Subject Group

1. This is a new series of audio cassettes on which recognised authorities discuss certain aspects of their subject. Each cassette is suitable for individual and study group purposes and is accompanied by a booklet containing diagrams, equations etc which, it is intended, should be followed by the student when he is listening to the spoken material. Additional copies of the booklets can be purchased to provide for group study needs.

Three titles are currently available:—

CC1. HEAVY METALS AS CONTAMINANTS OF THE HUMAN ENVIRONMENT by Derek Bryce-Smith.
This is a discussion of the effects on man of the increasing levels of pollution by heavy metals, particularly lead, cadmium and mercury. It is suitable for science sixth formers, science and medicine undergraduates and environmental group audiences.

Running time: approx 100 mins

CC2. SOME ASPECTS OF THE ELECTROCHEMISTRY OF SOLUTIONS by Graham Hills
On this tape, the speaker considers the nature and some of the properties of electrolyte solutions, showing how theoretical models can give a wider understanding of these. The cassette is mainly intended for undergraduate chemistry courses but might be found useful for some advanced level chemistry courses.

Running time: 34 mins

CC3. SOME ORGANIC REACTION PATHWAYS by Peter Sykes
On this cassette, the speaker concentrates on two types of reaction which are of the greatest importance in organic chemistry as a whole, namely, elimination and aromatic substitution. It is most suitable for sixth form and first year undergraduate chemistry courses.

Running time: 68 mins

A further cassette CC4. SYMMETRY IN CHEMISTRY by S F A Kettle is in course of preparation.

2. The quality of the recordings is good and in each case the spoken material is put across in a clear and concise manner with constant reference to the well labelled diagrams and equations in the accompanying booklet. Cassette CC3. is probably the most effective of the three under review. On this, Dr Sykes frequently poses questions, instructing the student to stop the tape to give himself the opportunity of considering his answer which is often a prediction dependent upon a clear understanding of the work already covered.

The standard of presentation of the diagrams and equations in the booklets is of a high order, making them very easy to follow in conjunction with the spoken material. Booklet CC1. includes a very useful list of references to further reading designed to extend the student's knowledge in an important subject area.

It is felt that these cassettes are "a significant new development in the field of chemical education" to quote the Editor Mr P Groves, and very reasonably priced at their current UK prices.

UK prices (including packing and postage within UK):–
CC1. £4.75
CC2. £3.80
CC3. £4.25

Additional copies of the booklets are available at 50p each or £4.00 for ten, from:–
Education Techniques Subject Group
The Chemical Society
Burlington House
London W1V OBN

13.7 **Core Chemistry** – D Garvil, J Reid and A Robertson. Published by Oxford University Press. Price £2.50 (soft-cover).
Designed to cover the "core" chemistry in the Scottish 'O' Grade examination, this book is also suitable for GCE 'O' Level and some CSE work. Its twenty one chapters (246 pages) of chemical theory are concisely presented, with plenty of clear diagrams and illustrations in an attractively spacious lay-out.

The subjects covered in this book are what one would expect to find in a modern, introductory, chemistry text at this level and include:

Atomic theory
Fuels
Macromolecules
Oxidation and reduction
Food chemistry
Corrosion

A summary of key concepts is given at the end of each chapter followed by a range of questions which test recall and understanding of the theory covered as well as providing useful discussion material.

A forty-page section of text-linked experiments follows chapter twenty one. The practical instructions are interspersed with questions designed to make the experimenter think carefully about his observations and to link these with results of previous experimental work. Attention is frequently drawn to safety precautions which must be observed.

Some will find the electron cloud diagrams a little strange, but many will regard them as a more effective aid to the understanding of atomic structure and bonding than the more traditional diagrams used in other text

books at this level. Where the authors have tended towards over-simplification as in chapters concerning ions and ionization, it is felt that they are justified, and their method of presentation does facilitate the understanding of basic concepts; this must surely be the aim of a text book of this type.

13.8 **Source Book for Environmental Studies.** Edited by P S Berry. Published by G Philip & Son Limited.
This book contains 250 pages of information on the types and sources of teaching material available in environmental studies/science. It is divided into 3 parts:–

> **Part One** classifies material – books, films, articles, posters, journals, work cards etc – under 29 environmental topics. These range from the better-documented topics such as ecology and natural history, to newer, more specialised topics such as "noise", and "reclamation and irrigation". For each item, an approximate price range is given.
>
> **Part Two** lists the sources from which materials may be obtained.
>
> **Part Three** provides other important background information on school examinations, university and polytechnic courses in Britain, and a glossary of environmental terms.
>
> An Appendix gives guidelines for possible teaching programmes in different aspects of environmental studies.

While the source book is designed for the teacher in Britain, a number of materials related to the environment in Asian, African and South American countries are listed; the book could be especially useful as a reading guide for teachers.

13.9 **Biology** – A Modern Introduction. B S Beckett. Published by Oxford University Press, price £2.50 for card cover editions.
This is a new book designed to give adequate coverage of most of the material required by 'O' level syllabuses in the UK and the 'O' grade syllabus in Scotland. Some parts of the text would also be suitable for CSE pupils.

The text is set out in six parts which cover:

> The nature and variety of life
> Nutrition
> The maintenance and organisation of life
> Sensitivity, movement, and co-ordination
> Reproduction, evolution, and heredity
> Interrelationships between organisms and their environment

There are twenty-two chapters each of which ends with a combined summary/factual recall test. Most chapters also include a comprehension test designed to test understanding of the information given, together with practical exercises which are in the form of guides to experiments or verification of experimental results from which key facts have been discovered. An inquiry exercise is included in most chapters, giving an opportunity for readers to make inquiries into knowledge which is not directly given in the text but which follows naturally from it. A useful glossary is included at the end of the book.

Chapters are set out under topic headings with plant and animal biology discussed under each. The author emphasises common concepts and principles which are explained in clear and easily understood terms.

Illustrations used in this book are of a high standard. Some of them are designed to show fine detail, others are simplified so as to draw attention to key features. A number of excellent photographs are also included. Diagrams which show structures that are microscopic or sub-microscopic in life, are particularly successful in conveying the correct ideas about spatial relationships of individual components of systems.

13.10 **Mathematics for Schools**. Edited by Harold Fletcher. Published by Addison-Wesley.
Infant: Level 1 Book 0
Pupils Book 47p
Teacher's Resource Book £2.30
A question frequently asked of British educationalists is: 'What is happening in primary mathematics in Britain?' It is a difficult question to answer, since so much is happening. The series of books colloquially known as 'Fletcher Maths' provides a simple representative answer. It is the series most widely used in Britain, and its approach is summed up in the comment in the introduction to this Teacher's Resource Book: 'We hope above all that children will enjoy their mathematics'. The whole series provides a comprehensive strategy of mathematics teaching for the first 8 years of school, along sound modern lines. It was reviewed in SEN 27:18:4, May 1975.

OVERSEAS ACTIVITIES

14. AUDIO-VISUAL MATERIAL FROM OVERSEAS CURRICULUM DEVELOPMENT PROJECTS

In the past few years, CEDO and more recently the British Council have been involved in the production of items of audio-visual material in collaboration with curriculum development projects in science and mathematics education in a number of countries. This material is in the form of films, filmstrips and tape-recorded commentaries. Its primary use is in teacher education in the countries concerned, and it has been used to good effect in both initial and in-service teacher training.

However, educationalists from many other countries have shown great interest in the material, and it is being used both in Britain and elsewhere to share ideas and techniques in curriculum innovation and in classroom practice. It is thought that a list of the available material will be of interest to readers of this Newsletter.

1. **Films**

(i) **Learning Science in Malaysia**

16 mm black and white film on the use of discovery-based science teaching at secondary level in Peninsular Malaysia. Produced by the Malaysian Ministry of Education in collaboration with CEDO. Running time 25 minutes. Available with either English or Bahasa Malaysia commentary.

Available for loan or purchase from Films Department, The British Council, London (through Representatives overseas).

(ii) **A Way of Looking**

16 mm colour film about the Caribbean Mathematics Project. This project (see SEN 28.15), which formally ended in mid-1975, operated at the junior secondary level. The film was made at the request of the School of Education, University of the West Indies, for use both in teacher education and to introduce the project to parents and others in the region. It was made by a team from the Department of Drama and Audio-Visual Aids of the University of Bristol. It has been widely used in Institutes and Colleges of Education in Britain as a study of a strategy of teacher-based curriculum development, and it has also been shown in a number of other countries. Running time 30 minutes. The film is accompanied by a discussion-guide containing both technical data and suggestions for the film's effective use.

Available for loan or purchase from Films Department, The British Council, London (through Representative overseas).

2. **Filmstrips**

These filmstrips are specifically for use with educational audiences, including teachers in training and those concerned with innovatory strategies in the teaching of mathematics at school level. Each filmstrip is accompanied by both a tape-recorded and a printed version of the commentary. The tape requires a reel-to-reel (not cassette) tape-recorder.

Caribbean Series

These four filmstrips were made as part of the Caribbean Mathematics Project.

(i) **Strategies of Curriculum Development**

Discusses two fundamental strategies of curriculum development. The first is the "central dissemination" model, in which teaching material is written and in-service courses organised by a small full-time project team, and in which teachers are recipients of both materials and training in their use. The second strategy is the "periphery" model, in which teachers are involved in writing materials, with the full-time project team playing an advisory and coordinating role. This second strategy is illustrated by the modus operandi of the Caribbean Mathematics Project. 75 frames.

(ii) **How a Unit of Work is Produced**

Traces the stages of development of a unit of teacher-written pupil material in the Caribbean Mathematics Project. The emphasis is on the need for testing material with children and revising it in the light of these trials before making it widely available. 79 frames.

(iii) **Teachers Write Booklets**

A study of small-scale teacher-based curriculum development, showing how a teacher can produce his own classroom material to high standards using only a typewriter and a duplicating machine. 42 frames.

(iv) **New methods in the Classroom**

New teaching materials imply new teaching methods. This study explores the use of group-work and worksheets at the lower secondary level, even in crowded classroom conditions. 59 frames.

Southern African Series

These three filmstrips were made as part of the Mathematics Workcards Project, which is operating at the lower secondary level in Botswana, Lesotho and Swaziland.

(i) **Why Use Workcards?**

Explains the reasons for breaking away from traditional textbook-based teaching in lower secondary classes which contain a wide range of ability. 26 frames.

(ii) **Organising the Classroom**

Discusses the changes needed in classroom management when learning is based on the use of workcards with children working individually or in small groups. 32 frames.

(iii) **The Role of the Teacher**

When workcards are the basis of learning, the teacher's function is very different from the traditional one. The various aspects of the teacher's new role are explored in this study. 34 frames.

Copies of all these filmstrips/tapes are available for loan or purchase from Science and Mathematics Education Unit, SFED, The British Council, London (through Representatives overseas).

15. CARIBBEAN

15.1 West Indian Science Curriculum – WISC (see SEN 14.33, 15.25, 29.18)

The West Indian Science Curriculum Innovation Project (WISCIP) was instituted in 1968, at the St Augustine, Trinidad, Campus of the University of the West Indies. Its initial aim was to produce a science curriculum for the new junior secondary schools being built in Trinidad.

A panel of science teachers in Trinidad selected, from five alternative curricula, the Scottish Integrated Science course as the most suitable for adaptation to West Indian conditions. At that time, neither Curriculum Paper No 7; "Science for General Education" (which describes the thinking behind the course) nor the pupils' or teachers' books were available, but the project team used an outline of the Units in the Scottish scheme as a basis for adaptation. While WISCIP in its original form and its various revisions and adaptations is distinctly Caribbean in its content and methodology, it has retained the basic structure of the Scottish course, and shares similar objectives.

By September 1969 the first draft of the first year material (pupils' worksheets and teachers' guide) was being tried out in 24 schools in Trinidad and the remainder of the three-year course appeared over the next 18 months.

1970, the Barbados Ministry of Education decided to adapt the original WISCIP (WISCIP/A) as a science curriculum for its comprehensive schools; this new version was known as WISCIP/B.

In the same year, the CEDO/UWI Caribbean Regional Science Project (CRSP) was started, to introduce a junior secondary science curriculum throughout the English-speaking Caribbean. They took WISCIP/B as their model and distributed it to about 80 pilot schools in the region. At a series of writing sessions, teachers and curriculum workers joined to re-write WISCIP on the basis of the trials in schools. The result, WISCIP/C, was tested in the pilot schools.

In Jamaica, since 1969, there has been a parallel development, **the MONA project**, based on the Jamaica National syllabus. This also is an integrated science course for the first three years of secondary school, and while it is distinct from WISCIP, there has been much association between the two projects.

WISCIP/C has now been edited on the basis of the evaluation results, and published by Heinemann Educational Books as WISC, West Indian Science Curriculum.

The books published are:

WISC workbooks 1 – 3
WISC Teachers' Guide 1 edited by Philip Adey.

Teachers' Guides 2 and 3 will be published shortly. The Teachers' Guides follow the units in the work-books in great detail, and give considerable advice on teaching methods as well as content. Guide 1 outlines the aims of WISC, and includes a useful bibliography, and notes on laboratory organization and SI Units.

As an exercise independent of the Project proper, separate textbooks have been produced which can be used with Caribbean Integrated Science courses:

Integrated Science for Caribbean Schools, (ISCS), Books 1–3, by F Commissiong, F Dalgety, C Jackson and A J Mee. Published by Heinemann Educational Books (Caribbean) Ltd. Book 1 only has been published so far.

This follows closely the sequence of units in the WISC guides and workbooks and each unit is cross-referenced. It suggests the same practical activities, though it expands on certain topics, with further suggestions for activities, and photographs. At the end of each unit, there is a summary of what has been learned, and a test. The book is very similar in layout and approach to the Scottish "Science for the 70's", and contains many coloured illustrations.

Science and People, Books 1–3, by Philip Adey and Rupert Sorhaindo. Published by Longman Caribbean. Book 1 has been published. The series is designed to accompany any of the new junior secondary science curricula in the Caribbean, notably WISCIP and the Mona project. It covers the same ground as WISC, but the order is rather different. "Science and People", while it contains many suggestions for practical activity, is intended to supplement, not supplant, the WISC books and other practical courses. Like ISCS, it ends each chapter with a summary and questions.

Each unit in the WISC teachers' guide gives cross-references to the same topic in "Science and People".

15.2 **Caribbean Mathematics Project**

As a follow-up to the Caribbean Mathematics Project (SEN 28.15), the School of Education of the University of the West Indies, Cove Hill, Barbados, has published the first issue of "Mathematics News: Caribbean Mathematics Project Bulletin", dated February 1976. The four-page bulletin contains short articles by local mathematics educators on the teaching of measurement, of decimals and of the division process, and on pupil assessment. Most refer to the primary school levels.

16. AFRICA

The First Pan-African Congress of Mathematicians, Rabat, 26–31 July 1976

The first Pan-African Congress of Mathematicians will be held at Rabat, Morocco from 26–31 July, 1976, under the auspices of UNESCO and IMU. It is hoped that it will be organized in close cooperation with ICMI.

The general theme of the Congress is "The mathematics and the development of Africa". The programme consists of two parts:

1. Mathematics proper, with priority given to the fields closely related to other sciences and engineering, such as:

- Partial differential equations and inequations and functional analysis
- Fourier analysis and representation theory
- Lie groups and analysis of varieties
- Numerical analysis
- Control theory
- Automatics
- Probability and statistics
- Mechanics
- Biomathematics
- Econometrics.

2. **Scientific policy**

A. Mathematical education in Africa

(a) Pre-university education (structure, curricula, diplomas).

(b) Higher Education (conditions of admission; organization of studies and examinations; mathematics for engineers; mathematics for other sciences: economy, medicine, pharmacology, social sciences and humanities).

(c) Recognition of mathematical studies and diplomas between African universities.

B. Creation of a Pan-African Mathematical Centre intended to be a centre for the formation of leading mathematicians; centre for scientific meetings and for advanced mathematical research.

C. Creation of African Mathematical Union.

D. Problems of cooperation between Africa and other continents principally in the domain of mathematics.

Further information may be obtained from:

Secretariat of the Organizing Committee
c/o Faculty of Science of Rabat
Avenue Moulay Cherif
Rabat
Morocco

17. EUROPE

European Study Group: Alternative Mathematics

The second meeting of the European Study Group for Alternative Mathematics took place from 27th to 29th March 1976, in London. The purpose of the Group is to develop a new strategy of mathematics education for those secondary school pupils whose needs are not being met by existing courses. It is thought that the new approach would be based on problem solving, and the Group is presently engaged on developing a taxonomy of problem-solving strategies.

The inadequacy of existing courses for the needs of less academic secondary pupils is a problem common to many countries. The Group includes mathematics educators from Britain, France, Holland, Luxembourg, Norway, Sweden, Switzerland and West Germany. It is hoped to hold the next meeting in Germany immediately preceding the third International Congress on Mathematical Education, August 1976.

INTERNATIONAL ACTIVITIES

18. **THE COMMONWEALTH ASSOCIATION OF SCIENCE AND MATHEMATICS EDUCATORS (CASME)** was inaugurated in London on 14 October, 1974 (SEN 26.28). It has already convened an important regional meeting in West Africa (SEN 29.25).

The following information is now available about CASME:

Objectives:

(a) To foster links between those concerned with education in science, technology and mathematics with special reference to the social significance of these subjects and their relationship to community education;

(b) To exchange views among members of the Association engaged in the process of integrating studies of science and mathematics into existing cultures, customs and the developing technology of a country;

(c) To provide a clearing house for the assembly and dissemination of knowledge of schemes related to the objectives of the Association.

Activities:

The objectives of the Association will be pursued by:—

(a) Providing a discussion forum for those engaged in developing work related to the particular needs of Commonwealth countries;

(b) Exchanging views on ways in which teachers of science and mathematics can develop their own local and regional work and encouraging appropriate local schemes for initial and in-service education of teachers;

(c) Exchanging views on the provision of appropriate education facilities in both urban and rural situations;

(d) Promoting the creation of projects which would be likely to benefit groups of countries facing similar problems of evolving new educational patterns.

Membership:

(a) All applications for membership of the Association shall be made to and shall be dealt with by the Council.

(b) The Council shall in its absolute discretion, admit to membership institutions, organizations or any of their constituent parts and individuals able in their opinion to further the objectives of the Association.

(c) The subscription for all classes of membership shall be determined by the Council from time to time.

Finance:

CASME will be financed by annual fees from member associations. The rates are:

Institutional & Organizations	US$ 20 per annum
Individuals	US$ 5 per annum

The Council:

The management of the business of the Association shall be vested in a Council, which shall consist of: President, Five Vice-Presidents and Six Members.

Further Information:

Enquiries and application for membership should be addressed to:

The Secretary, CASME
Office of the Scientific Adviser
Commonwealth Secretariat
Marlborough House
Pall Mall
LONDON SW1Y 5HX

19. **SYMPOSIUM: AN INTERDISCIPLINARY APPROACH TOWARDS THE TEACHING OF NATURAL SCIENCES AT SECONDARY LEVEL**

The report on this symposium which was arranged through the Council of Europe Committee for General and Technical Education and held at the University of Exeter from 8 to 14 September 1974, is now available. Copies can be obtained from the Division for General and Technical Education, Secretariat General, Council of Europe, Strasbourg 67006.

The aims of the Symposium were:

(a) to seek to define what is meant by the term "interdisciplinary".

(b) to identify problems which arise when putting into practice an inter-disciplinary approach to the teaching of science subjects to pupils in the 11–16 age range.

(c) to review the present state of interdisciplinary programmes in the member states represented at the Symposium.

(d) to make recommendations to the Council of Europe and member states on the basis of the conclusions reached on the above points.

The delegates were organised into two working groups, and their reports make very interesting reading for the science educator.

There was considerable enthusiasm for some form of integrated or interdisciplinary science at the lower secondary level but rather less commitment to it in the 13–16 age range. Stress was placed on the social implications of science and to a lesser extent on the needs of pupils of differing abilities.

The reports justify the teaching of integrated science on the grounds that it best meets the needs of the child, but at the same time indicate the constraints which make implementation difficult in schools.

20. EDUCATIONAL TECHNOLOGY IN THE TEACHING OF CHEMISTRY

The report of a symposium on this subject held in Madrid in September 1975 has recently been published by the International Union of Pure and Applied Chemistry, 2/3 Pound Way, Cowley Centre, Oxford.

The report contains the 10 specially commissioned symposium papers together with reports from 20 countries represented at the symposium. The papers are:

Enhanced Potentialities of New Educational Technology, by C N R Rao (India); Developments in the Tools of Educational Technology in Chemical Education during the last decade, by W T Lippincott (USA);

Educational and other factors affecting the selection of techniques for effective teaching, by M J Frazer (UK);

Mass Media in Chemical Education, by L J Haynes (UK);

Effectiveness of Tools of Modern Educational Technology in the Teaching of Chemistry, by I V Berezin (USSR);

Programmed Learning in Chemistry: Where do Computers come in? by J A Young (USA);

Computer Assisted Instruction in Chemical Education, by A Kornhauser (Yugoslavia);

Educational Technology in Developing Countries – Problems and Challenges, by R C Mehrotra (India);

Educational Technology in Developing Countries – Problems and Challenges, by A H Guerrero (Argentina);

International Cooperation in Educational Technology, by C N R Rao (India).

Each of the commissioned papers is followed by a comprehensive bibliography and these alone make the publication of particular value for those working in this field.

The country reports include Argentina, Australia, Brazil, Canada, Czechoslovakia, Denmark, Egypt, Federal Republic of Germany, France, German Democratic Republic, Hungary, India, Ireland, Israel, South Africa, Spain, United Kingdom, USA, and Yugoslavia. The report, which has been published with the assistance of UNESCO, was edited by Professor C N R Rao (India) who is currently the Chairman of the IUPAC Committee on the Teaching of Chemistry. Copies are being distributed to all participants and to the National Adhering Organisations of the IUPAC. Copies may be purchased from the IUPAC Secretariat, price £2.50 including postage and packing (address above).

21. INTERNATIONAL ENVIRONMENTAL EDUCATION PROGRAMME

The main goal of the International Environmental Education Programme set up in January 1975 is to create a comprehensive network of communication, to encourage the exchange of information, ideas and experience in this field of education.

As part of this effort, UNESCO has introduced a newsletter, "Connect". The first issue, printed on recycled paper, contains the Belgrade Charter formulated at the Belgrade International Workshop in October 1975; this provides the framework and guidelines for global environmental education.

Future issues of "Connect" will appear quarterly, or more frequently if demand is high. Each will have a dominant theme, but will also contain regular sections giving news of: UNESCO activities; other organizations involved in environmental education; regional and national plans, projects and meetings; books, films and other printed or audio-visual materials. The editors would welcome contributions to and comment about the newsletter.

"Connect" is also produced in French as "Connexion", and in Spanish as "Contacto". It is available from:

Environmental Education Section
Division of Pre-University Science & Technology Education
UNESCO
7 Place de Fontenoy 75700 Paris
France

22. SCIENCE EDUCATION AND NATION BUILDING

This was the theme of an international workshop held in the British Council, Accra, Ghana, from 3–8 November 1975, to coincide with the 20th anniversary celebration of the Ghana Association of Science Teachers, GAST (see SEN 27.19).

The workshop was sponsored by GAST in cooperation with UNESCO, ICASE (International Council of Associations for Science Education), the Ghana Education Service, and with assistance from the Science Education Programme for Africa (SEPA), and the International Coordinating Committee for the Presentation of Science and the Development of Out-of-School Scientific Activities (ICC).

The workshop brought together 25 foreign participants (including delegates from 9 African countries), and 70 local participants and observers.

The objectives of the workshop were:

(i) to find possible means of cooperation among science teachers' associations in Africa.

(ii) to offer science teachers in Ghana the opportunity to discuss ideas of common interest with their counterparts from other countries.

(iii) to find out how national science teachers' associations can cooperate most effectively with international organisations in promoting science education in the various countries.

(iv) to review the aims and objectives of science teachers' associations in Africa, and the role of these associations in programmes for nation building.

Working sessions were held, aimed at:–

(a) reviewing various strategies for curriculum development in science;

(b) making suggestions for the organisation and running of science teachers' associations;

(c) suggesting strategies for promoting cooperation among science teachers' associations in Africa;

(d) producing a guide for the organisation and running of science clubs and science fairs.

In each case, a list of recommendations was drawn up.

Copies of the report of this workshop are available from:–

D G Chisman
Science and Mathematics Education Unit
The British Council
10 Spring Gardens
London SW1A 2BN

23. ICMI-JSME REGIONAL CONFERENCE IN TOKYO – PUBLICATION OF PROCEEDINGS

The Proceedings of the ICMI-JSME Regional Conference on Curriculum and Teacher Training for Mathematical Education, which was held in Tokyo on 5–9 November 1974 and reported in SEN 26.33, were published in August 1975 by the Japan Society of Mathematical Education as a special issue of "Report of Mathematical Education" one of its official journals.

The account of the Proceedings contains in its 272 pages all the lecture texts of invited speakers:– Professor M H Stone, Dr A G Howson, Academician S L Sobolev, Professor A Lichnerowicz, Mr J Vanniasingham, Professor Dr H G Steiner, and Professor Y Akizuki. It also includes papers presented in the Working Groups (10 papers in the Working Group A "Mathematics in Primary School", 9 papers in the Working Group B

"Mathematics in Secondary School", 9 papers in the Working Group C "Preparing Teachers of Mathematics in Training Institutes", 8 papers in the Working Group D "Inservice Training", and 8 papers in the Working Group E "Educational Technology in Mathematical Education"), together with brief outlines of discussions related with the invited lectures and the presented papers. There is a summary of what the participants saw and heard in schools and institutes where they visited during the Conference as a part of the programme.

The price of a single copy of the Proceedings is US$ 18.00, which includes costs for postage by surface mail and handling, and copies are available from the following by order with remittance.

The Secretary
Japan Society of Mathematical Education
c/o Tokyo University of Education
29-1 Otsuka 3-chome, Bunkyo-ku
Tokyo
112 Japan

Remittance should be made through mail transfer advice and payable to:

Nihon Sugaku Kyoiku Gakkai
Kyowa Bank, Myogadani Branch, Account No 140942.

24. **THIRD INTERNATIONAL CONGRESS ON MATHEMATICAL EDUCATION (ICME), Karlsruhe, Federal Republis of Germany, 16–21 August, 1976.**

Advance notice of this Congress was given in SEN 26 and 29, and further details are now available.

Opening: Monday, August 16, 1976, 1600.
Closing: Saturday, August 21, 1976, 1200.

Congress languages are English, French, Russian and German.

Postal Address

3rd International Congress on Mathematical Education 1976
Kaiserstrasse 12, University of Karlsruhe
D 7500 Karlsruhe
(Federal Republic of Germany)

PROGRAMME

Plenary Sessions

There will be 6 main papers by invited speakers devoted to matters of general interest in mathematics and the didactics of mathematics. During Plenary Sessions these papers will be simultaneously interpreted into English, French and German.

So far, the following invited speakers have accepted an invitation to present a main paper:

G Th Guilbaud (Ecole Pratique des Hautes Etudes, Paris, France),

P J Hilton (University of Washington, Seattle, USA),

A Kirch (Gesamthochschule Kassel, Germany),

Sir James Lighthill FRS (University of Cambridge, Great Britain).

Survey Reports in the Sections

Particular emphasis of the Congress activities will be on the 13 sections. At the opening of each section an invited speaker will present a survey-trend report which is being prepared in collaboration with an appointed Advisory Group.

Themes and invited reporters of the various sections are:

A1. Mathematics education at pre-school and primary level (ages 4–12) F Colmez, France.

2. Mathematics education at upper primary and junior high school level (ages 10–16) A Z Krygovska, Poland.

3. Mathematics education at senior high school, college and university transition (ages 15–20) D A Quadling, Great Britain.

4. Mathematics education at university level (excluding teacher training) J H van Lint, Netherlands.

5. Adult and continuing education in mathematics (with reference to correspondence studies) R M Pengelly, Great Britain.

6. The training and the professional life of mathematics teachers, M Otte, Germany.

B1. A critical analysis of curriculum development in mathematics education, A G Howson, Great Britain.

2. Methods and results of evaluation with respect to mathematics teaching, J Kilpatrick, USA.

3. Overall goals and objectives for mathematics teaching (Why do we teach mathematics?) U d'Ambrosio, Brasil.

4. Research related to the mathematical learning process, H Bauersfeld, Germany.

5. A critical analysis of the use of educational technology in mathematics teaching, R Heimer, USA.

6. The interaction between mathematics and other school subjects (including integrated courses) H O Pollak, USA.

7. The role of algorithms and computers in teaching mathematics at school, A Engel, Germany.

Abstracts of the survey reports will be available in English, French, German and Spanish versions. They will contain the essentials of the respective subjects as well as questions and suggestions for the discussion and thus form a background material for the work in the sections.

Abstracts of the survey reports and accounts of the work in the various sections will be printed in the Congress Proceedings. The survey report will be revised by the reporters after the Congress and published by UNESCO as volume 4 of the series "New Trends in Mathematics Teaching".

Participants are reminded that several of the working-groups that were formed at the second ICME, Exeter 1972, will hold a half-day follow-up meeting at Karlsruhe. In particular, the group on "Mathematics in Developing Countries" will meet to consider the theme "Secondary Mathematics in Developing Countries: the needs of the average student". Anyone who expects to be at Karlsruhe and who would like to take part in this session is asked to write to B J Wilson, Science and Mathematics Education Unit, SFED, The British Council, 10 Spring Gardens, London SW1A 2BN as soon as possible.